Jets in the first DØ RunII data

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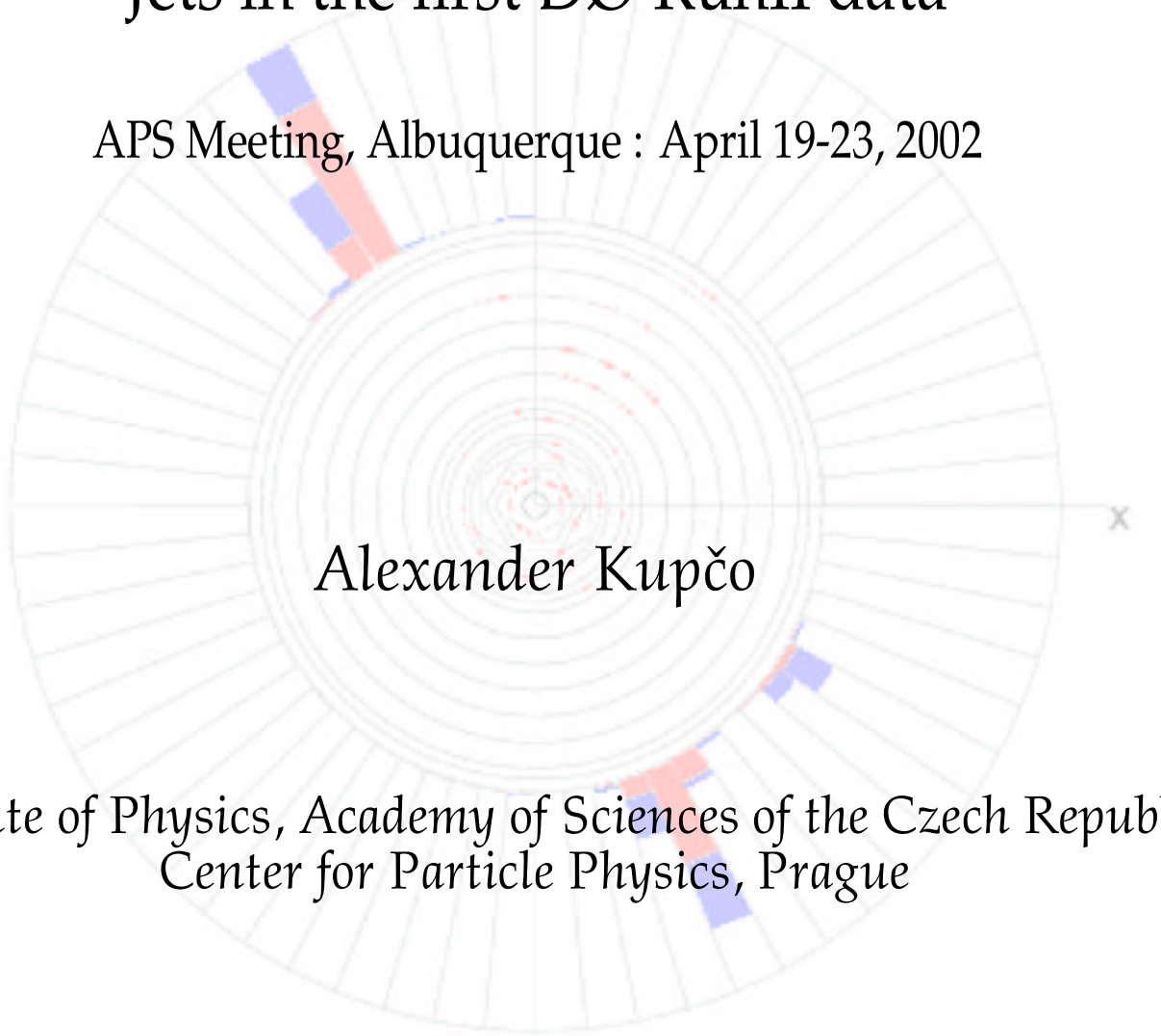

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Jets

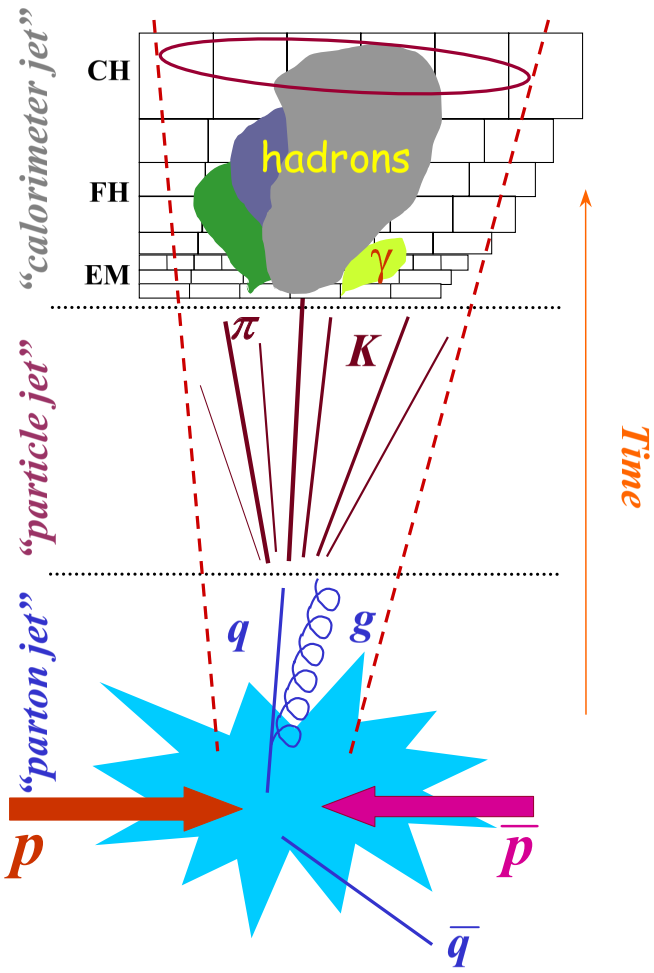
- calorimeter jet
  - calorimeter - *main tool for jet measurement*
  - jet is collection of towers *within a given cone* R

$$R = \sqrt{\Delta^2\varphi + \Delta^2\eta}$$

  - φ is the *azimuthal angle*
  - pseudorapidity η is related to the polar angle ϑ

$$\eta = -\log\tan\left(\vartheta/2\right)$$

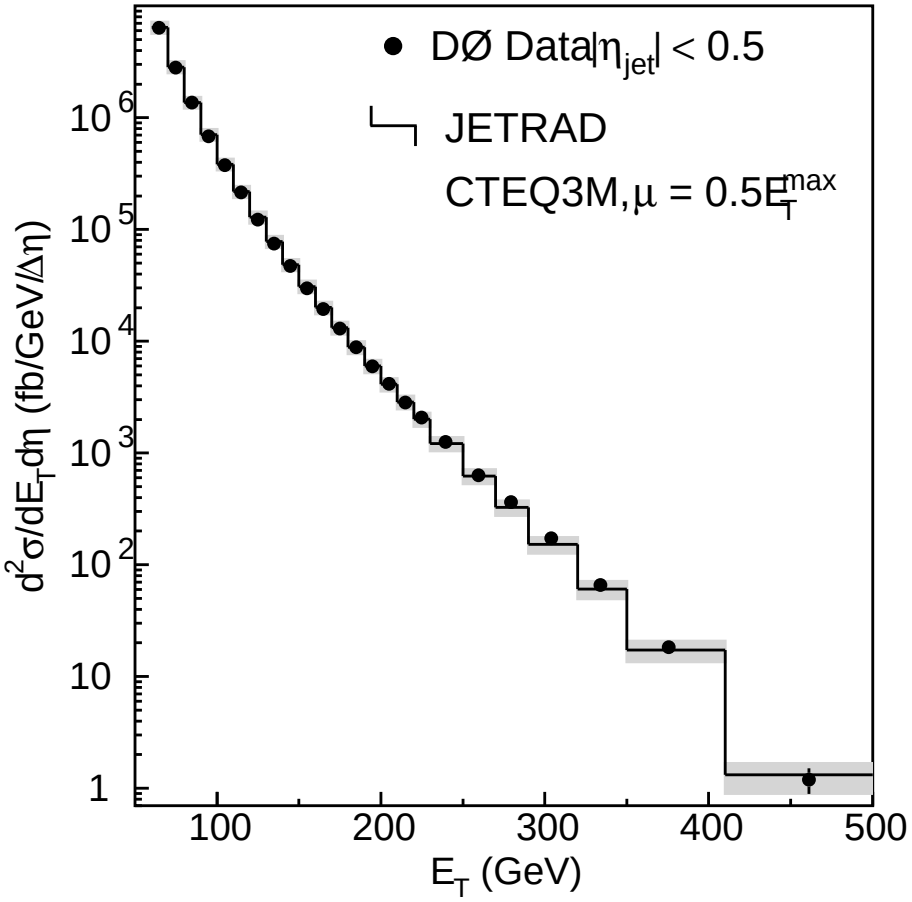
  - cone direction - *maximises total* E_T *of the jet*
- particle jet
  - *after hadronization*
  - *a spread of particles running roughly in the same direction as the parton*
- parton jet
  - *parton hard scattering and parton showers described by pQCD*



Jets in RunI data

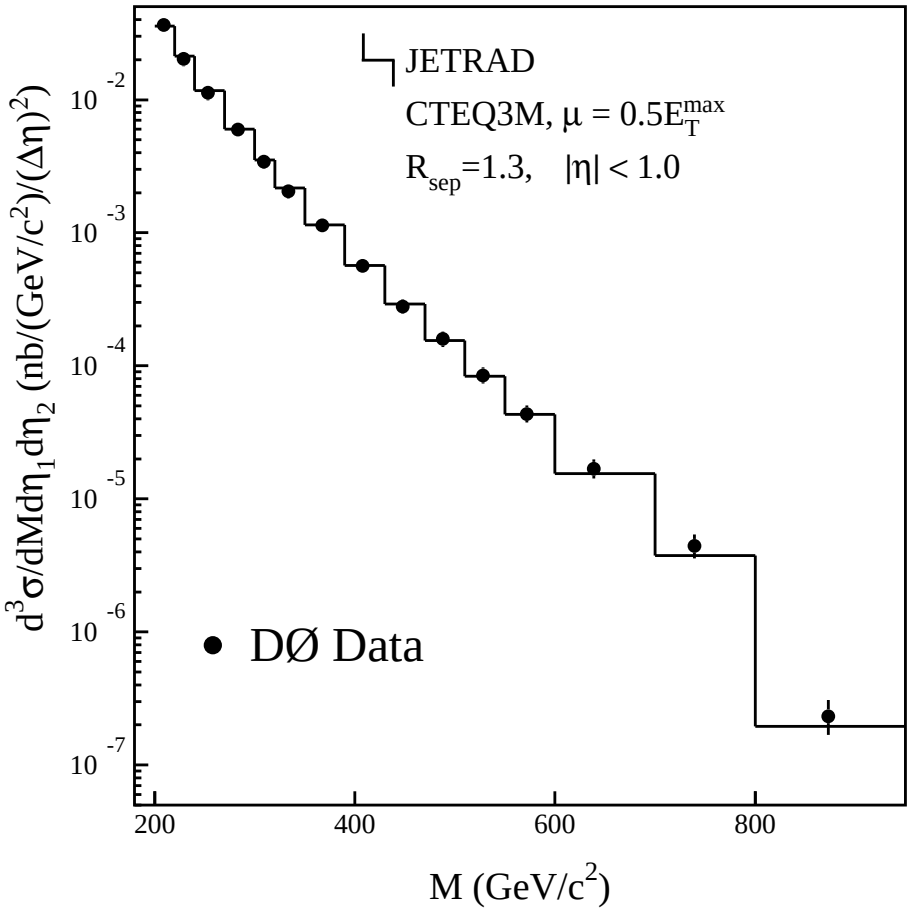
- basic jet distributions (like inclusive jet p_T cross section or dijet mass cross section) are well described by pQCD

RunI jet inclusive spectrum



Phys. Rev. D 64, 032003 (2001)

RunI dijet mass spectrum



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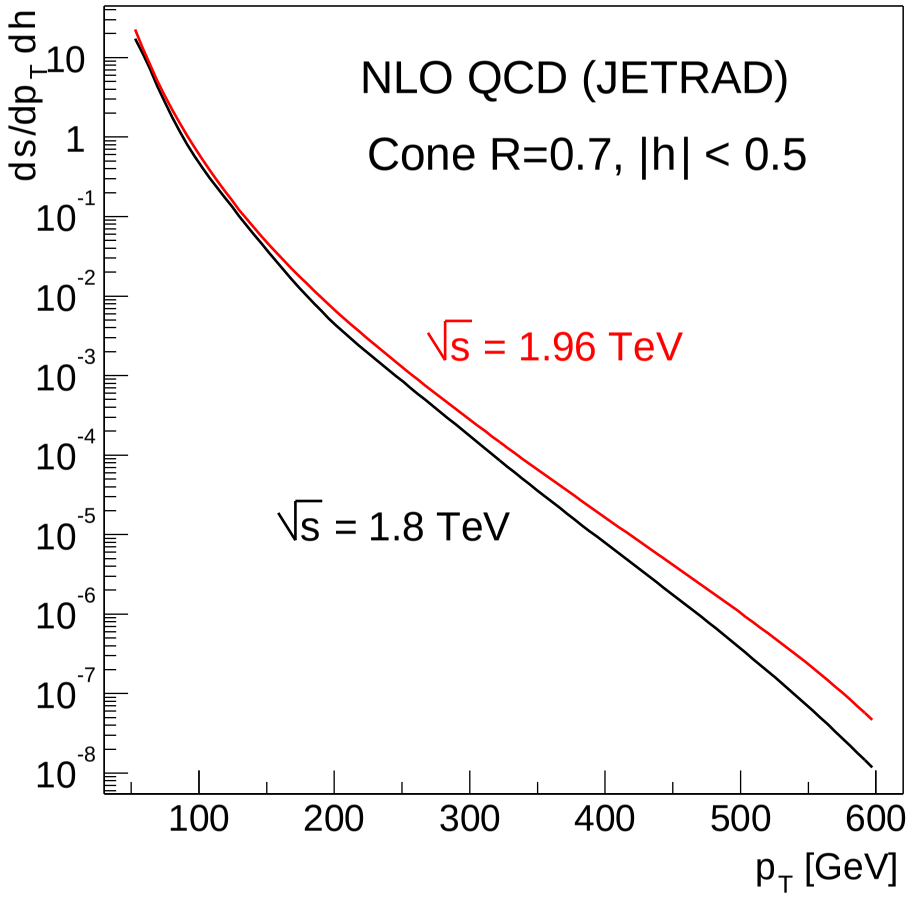
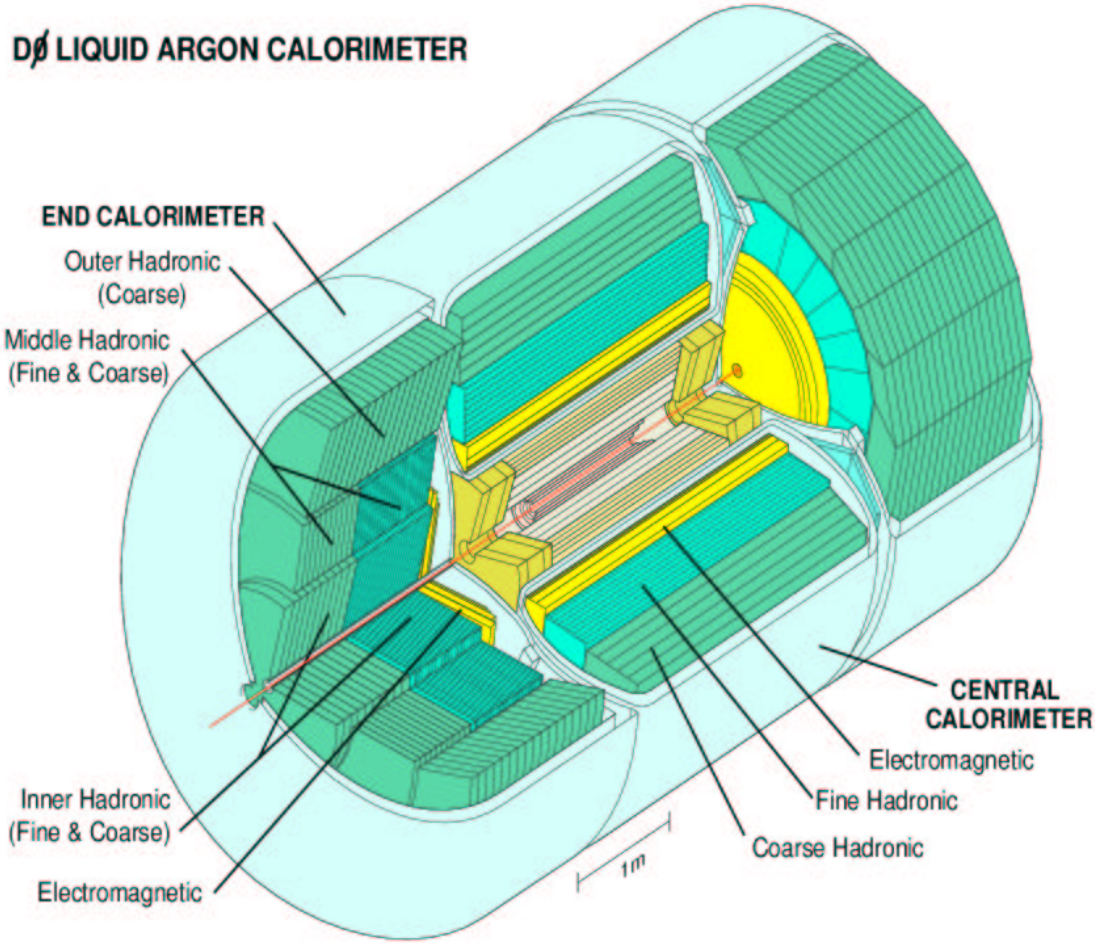
High pT jets in RunII

- slightly higher CMS energy
  - cross section is more than 2 times larger for jets with $p_T > 400\,\mathrm{GeV}$ at $1.96\,\mathrm{TeV}$ than at $1.8\,\mathrm{TeV}$
- higher luminosity
  - $109\,\mathrm{pb}^{-1}$ in RunI
  - expect $2\,\mathrm{fb}^{-1}$ in RunIIa
- higher statistics for high p_T jets
  - improve knowledge of proton structure at large x, especially the gluon distribution
  - searches for new physics (quark compositeness, excited quarks, Z′, W′, extra dimensions, . . .)

jet inclusive p_T spectrum



Calorimeter

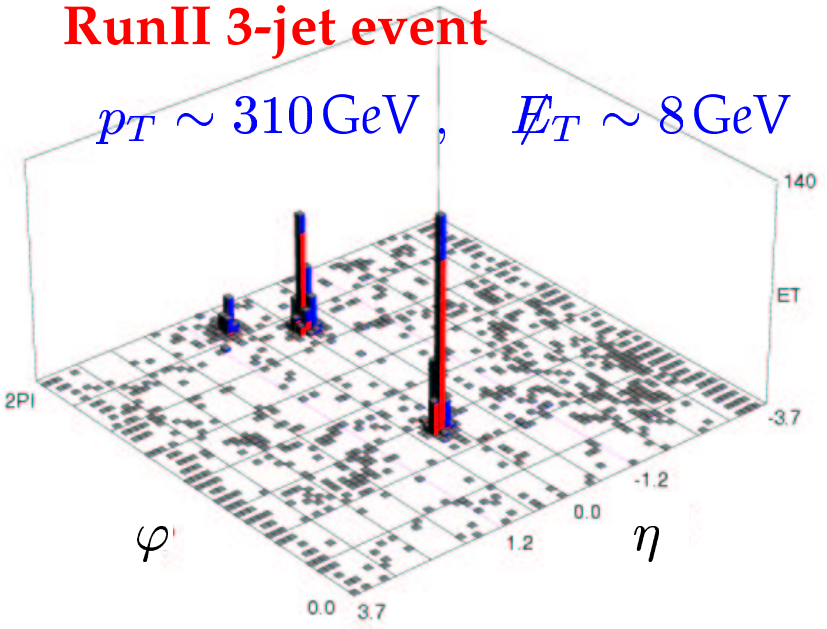


- uniform and hermetic
  - coverage up to $|\eta| < 4.2$
- compensating ($e/\pi \sim 1$)
- fine segmentation
  - $\Delta\eta \times \Delta\varphi = 0.1 \times 0.1$
- RunI - excellent performance
  - good energy resolution

$$\sigma_E^{EM}/E \approx 15\%/\sqrt{E}$$
$$\sigma_E^{HAD}/E \approx 50\%/\sqrt{E}$$

RunII 3-jet event

$p_T \sim 310\,\mathrm{GeV}$, $\not\!\!E_T \sim 8\,\mathrm{GeV}$



- **RunII upgrade**
  - shorter time between bunch crossings (396 ns)
  - faster trigger and readout electronics

▷ 100% commissioned
  - only 50 bad channels out of 55000

Data sample

- DØ RunII data taken during February and March 2002
- $p\bar{p}$ collisions at $\sqrt{s} = 1.96\,\mathrm{TeV}$, integrated luminosity is $\mathcal{L} = 1.9\,\mathrm{pb}^{-1}$
- all results are for jets with cone size $R = 0.7$ in the central calorimeter region ($|\eta| < 0.5$)

Selection criteria

- event selection
  - cut on missing E_T, $\not\!\!E_T < 0.7\, p_T^{jet1}$
  - cut on primary vertex position, $|z_{vtx}| < 50\,\mathrm{cm}$
  - cut on total energy deposited in calorimeter, $E_{cal} < 2\,\mathrm{TeV}$
- jet selection criteria – based on EMF, CHF, HotF, n90

Current corrections

- jet energy scale correction
- correction for vertex selection cut
- no other correction factors applied (unsmearing, trigger efficiencies, jet selection efficiencies, ...)

Jet energy scale

▷ correction of the jet energy measured on the detector level to the jet energy on the particle level

$$E^{jet}_{ptcl} = \frac{E^{jet}_{det} - O}{R_{jet}\, S}$$

Offset, O

- energy not associated with the hard interaction (U noise, pile-up, underlying event, additional $p\bar{p}$ interaction)

Response, R_{jet}

- calorimeter response to the jet
- EM part calibrated on $Z \to ee$ mass peak
- measured from E_T balance in γ+jet events

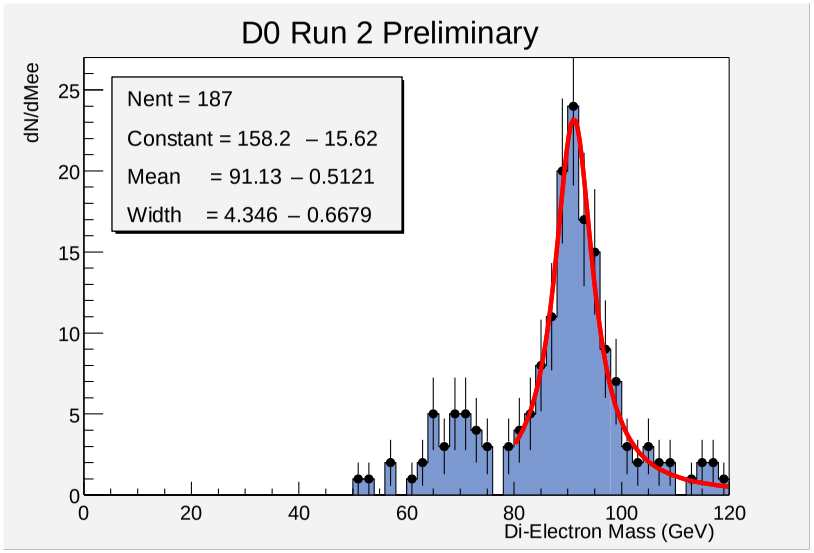
Showering, S

- losses due to showering the energy in the calorimeter out of the jet cone

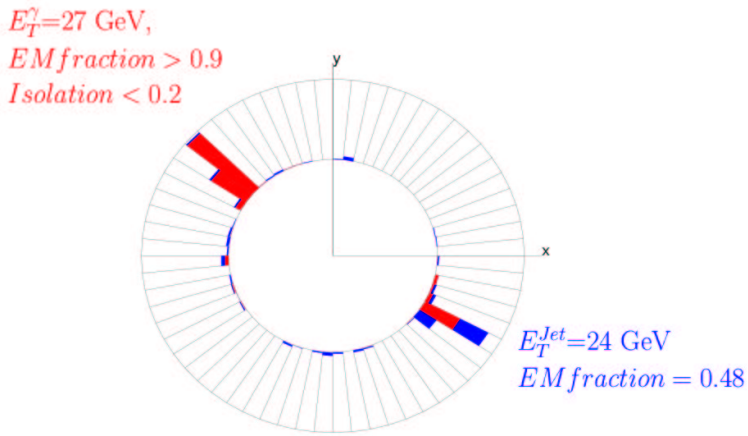
▷ preliminary jet energy scale correction

- systematic error about 10% on jet energy

$Z \to e^+e^-$



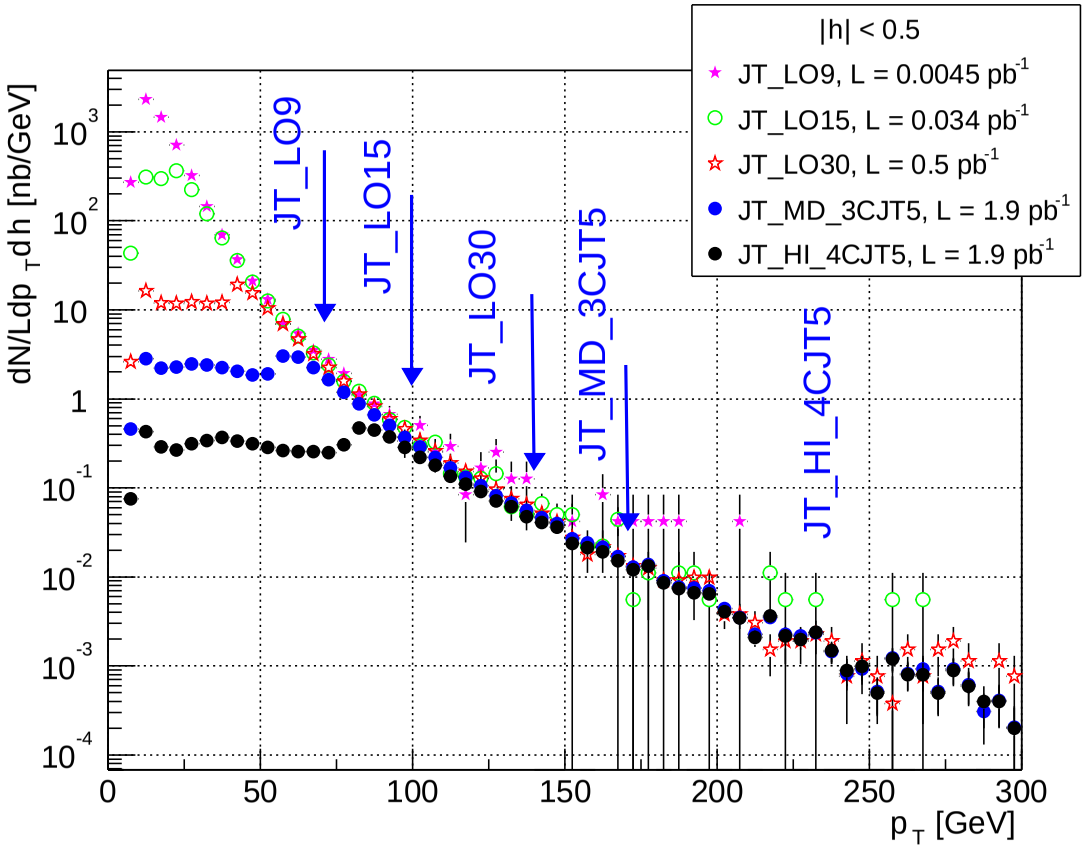
photon + jet



Jet triggers

Trigger system is essential for measurement of rare processes

- allows to select the desired events
- control of too frequent processes
- high luminosity means high bunch crossing rate (2.5 MHz)
- able to write events to tape with rate 50 Hz



Hardware triggers

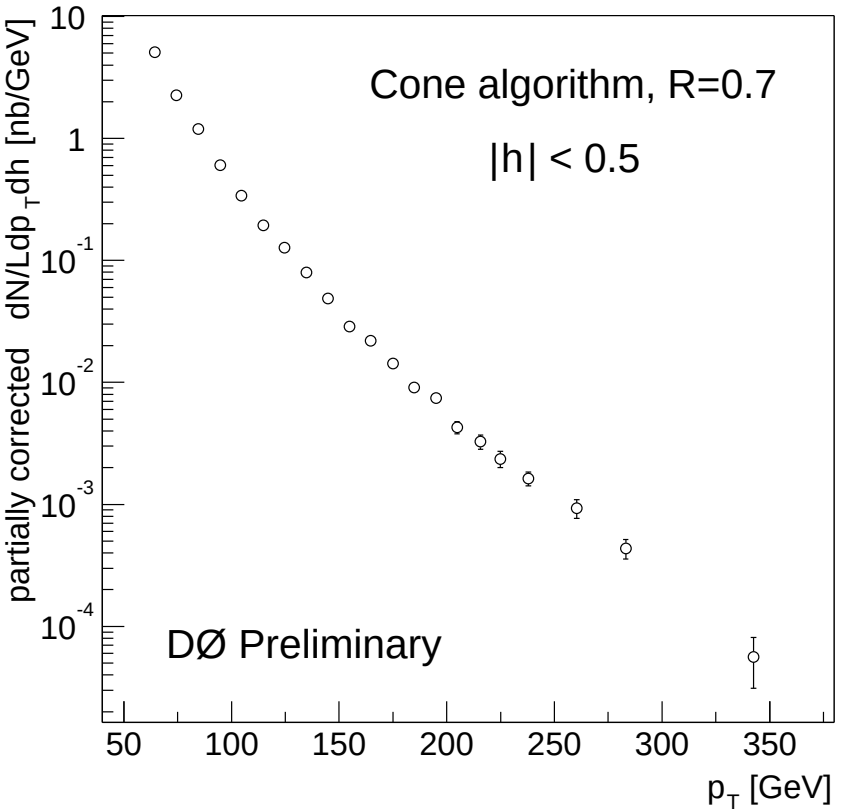
- triggering on calorimeter towers
- fast trigger readout
- current coverage up to $|\eta| < 0.8$
- multi tower triggers

Software triggers

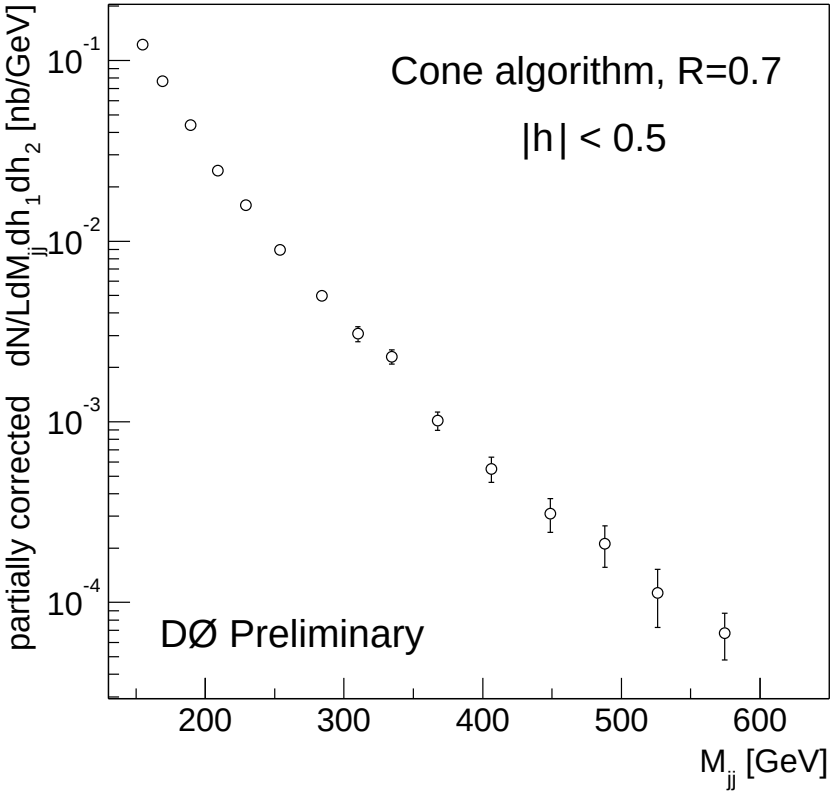
- PC Linux farm
- run simple and fast jet algorithm on the precision readout

Results

Inclusive jet p_T spectrum



Dijet mass spectrum



- only statistical errors
- integrated luminosity $\mathcal{L} = 1.9\,\mathrm{pb}^{-1}$ (uncertainty about 10%)
- preliminary jet energy scale correction
  - 30-50% systematic error in cross section
- not fully corrected (unsmearing, selection cuts efficiencies, trigger efficiencies, . . .)

Summary

- preliminary results on
  - jet inclusive p_T spectrum ($60\,\text{GeV} < p_T < 360\,\text{GeV}$)
  - dijet mass spectrum ($150\,\text{GeV} < M_{jj} < 650\,\text{GeV}$)

  measured in the first DØ RunII data were presented
- although not fully corrected (and hence not comparable to theory), they show
  - DØ detector operates properly after the upgrade
  - RunII jet measurements are well underway
- looking forward to more data